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AGRICULTURAL
Research

VOL. 2—MAY 1954—NO. 11

JOSEPH F. SILBAUGH—MANAGING EDITOR

Hand with a head

Shocking grain under a burning sun . . . pitching bundles into a dusty thresher. Don't see much of that any more. We harvested almost 95 percent of our small grains by combine in the United States last year.

Farming changes—and so do the qualifications of a good farm hand. Brawn and endurance were once his big tests. But today they're outweighed by the need for skill, experience, and technical knowledge.

He's not so much concerned with pitchforks and hoes as with machines, chemicals, equipment, drugs, feeds, and scientific methods.

These days, even a modest family-operated commercial farm is likely to own around $12,000 worth of machinery. Some have much more.

There are machines for preparing the soil, for planting the seed, for applying chemicals. There are corn and cotton pickers, silage choppers, pickup balers, potato and sugar-beet harvesters. It took 10 billion gallons of fuel and oil last year alone to keep them going.

And it took something else: farm hands who could operate these machines and take care of them. A carelessly run cultivator can cover corn or cotton plants. Bad handling can bring on a combine breakdown that ties up harvesting. An ungreased bearing can quickly wear out.

Farm hands must understand the application of fertilizers, insecticides, fungicides, herbicides. Gasoline and poisons must be handled.

Then there's the equipment that electrification of more than 90 percent of our farms has given us: milking machines, fence controllers, stock clippers, barn cleaners, welders, grain elevators, tool grinders, chick brooders. A good farm hand must understand these too.

Caring for cattle, hogs, and poultry may demand even more of him. He must recognize common ailments, give first aid, act as a midwife. Feed-mixing and feeding are often complex. Production may slump if a routine slips. Strict sanitation is necessary in handling milk.

The ability of farm hands—there are a million regulars—to keep up with mechanization and improved practices has had a lot to do with our remarkable farm output: 30 percent larger in 1953 than in 1940—with about the same amount of land and a sixth fewer manhours.

Extension workers, vocational-agriculture teachers, and others who have helped train our farm hands can feel pride in this achievement.

AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

POLLEN on the honeybee in this cotton flower cross-pollinates other plants as the bee looks for more nectar. Surprise result: Bigger cotton yields (page 5). *USDA photo by Forsythe.*

Contents

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Easing the COST SQUEEZE

HOW can a farmer help himself in today's dilemma of higher production costs and lower prices for the crops he grows?

Following recommended cultural practices can supply part of the answer, according to the results of field tests carried on in Michigan.

Cooperating agricultural economists and soil scientists of ARS and the Michigan experiment station studied production costs (based on 1953 prices) of five important crops. Some were grown under what were observed to be current practices, some under recommended practices. Findings are summarized in the table below.

Farmers were spending more per acre to follow recommended practices, the scientists found, but bigger yields more than offset this additional expense. Take wheat, for example. Under current production methods, it cost $40.05 to grow 26 bushels per acre. But recommended practices, which cost $60.05 an acre, boosted yields to 47 bushels.

Practices that cut production costs were such familiar items as adequate fertilization and timely planting of treated seed of the right variety on adapted, properly drained soils. Correct rotation, tillage, and weed control also were important.

Adequate fertilization was frequently the most expensive improvement—but it was generally more effective in reducing production costs than any other single practice.

Michigan farmers currently apply an average of 55 pounds of fertilizer, or about $1.65 worth, to each acre of alfalfa-brome grass hay they grow. The recommended fertilizer rate for this crop is 200 pounds, or $6 worth, per acre. If farmers did no more than increase fertilizer use to recommended levels—otherwise going along with current production methods—this one change would cut the cost of producing a ton of alfalfa-brome hay from $16.80 to $15.28.

When fertilizer rates were kept the same (55 pounds per acre) but other practices were improved over current methods, hay production costs were trimmed from $16.80 to $14.25 a ton. Fertilization at the 200-pound rate—together with the other improved practices—lowered costs from $15.28 to a low of $13.30 a ton.

The tests emphasize that although production costs can be cut by improving any *one* cultural practice, the biggest savings come from applying *all* the recommended methods.☆

RAISING	WHEAT	OATS	CORN	HAY ALFALFA-BROME	SUGAR BEETS
BY CURRENT METHODS	COST $1.54 per bushel	COST $0.90 per bushel	COST $1.21 per bushel	COST $16.80 per ton	COST $11.21 per ton
BY RECOMMENDED METHODS	COST $1.28 per bushel	COST $0.69 per bushel	COST $1.02 per bushel	COST $13.30 per ton	COST $8.19 per ton

Unidentified growth factor in EGG YOLK?

Does egg yolk contain a growth factor—one previously unrecognized?

It's surprising that something may have been missed in the much-worked-over egg. Yet, ARS poultry researchers C. A. Denton, R. J. Lillie, and J. R. Sizemore find that chicks respond to yolk in their diet.

They have also found, along with other researchers, that growth can be stepped up by including lard.

And chicks fed both egg yolk and lard make remarkable gains on less feed than birds on an ordinary diet.

These discoveries grew out of efforts to estimate the amount of vitamin B_{12} in egg yolks. Chicks need this vitamin for top growth, and research shows it's carried over from hen to chick through the egg.

The scientists tried two methods of estimating egg-yolk B_{12}. One test uses B_{12}-hungry bacteria, the other chicks. In both cases, their growth is first measured on diets containing known amounts of pure, crystalline B_{12}. This provides standards with which to compare growth on the same diets with B_{12}-carrying egg yolk added instead of the pure vitamin.

Bacteria and chicks gave the same results with pure B_{12} in the diet. On the diet with yolk in it, however, the chicks showed B_{12} values 8 to 10 times greater than the bacteria. Apparently, the chicks were responding to something else in the yolk besides B_{12}. What was it?

Denton and his associates now put some chicks on a basal diet with everything chicks are known to need—except animal protein and an unidentified factor in fish-solubles.

A second group got this same basal diet plus 4 percent fish solubles. These chicks gained 9 percent more.

Thinking that fat's high-energy value might be involved—egg yolk is 30 percent fat—the scientists tried another group of chicks on the basal diet plus 8 percent lard. This increased growth 6 percent.

With 10 percent egg yolk in the basal diet, growth jumped 17 percent.

And adding all three increased growth 32 percent—which equals the sum of 9 (from fish solubles), 6 (from lard), and 17 (from egg yolk).

So we seem to be dealing with three separate growth stimulators:

1. Fish solubles. Adds animal protein and an unidentified factor.

2. Lard. Adds energy and may increase the feed's palatability. This suggests an outlet for animal fats.

3. Egg yolk. Adds energy—plus something else (yolk from many sources gave similar results). It may be a known egg component that hasn't been recognized as a growth factor.

Denton, Lillie, and Sizemore are attempting to identify the egg-yolk factor, which might be obtained from a cheaper source. Keep in mind that their experiments have been made in the laboratory with small numbers of birds. Chicks probably wouldn't give such exceptional responses under ordinary conditions.

But eventually this research could pay off in more efficient feeds.☆

Early embryos in TURKEY EGGS make most and best poults

Fertility in turkey eggs can be determined more accurately by candling the eggs individually after 24 hours of incubation and again after 32 hours than by the usual practice of candling after longer periods.

ARS poultry researchers M. W. Olsen and S. J. Marsden reached this conclusion after incubation tests on some 4,000 Beltsville Small White eggs. It was Olsen and Marsden who discovered parthenogenesis in turkey eggs (AGR. RES., Aug. 1953).

Results indicate (1) the largest number and best poults come from eggs that show fertility within 24 hours of incubation; (2) true fertility, for practical purposes, shows up by 72 hours; and (3) eggs showing embryonic development beginning after 72 hours are largely parthenogenic and don't produce poults.

Thus, there appears to be substantial error in the results obtained by breeders and research workers in testing for turkey-egg fertility after a week or more of incubation.

Olsen and Marsden point out that many eggs that look fertile when candled after 7 days of incubation are probably not truly fertile. Mere presence of an embryo and blood, found by candling or breaking out, doesn't necessarily indicate true fertility. This was apparent from the tests: about 5 percent of the parthenogenic eggs had blood formation and 2 percent developed true embryos.

The tests also cleared up another point. Hatcherymen follow the practice of "table candling" turkey eggs after about 24 days of incubation and paying for the eggs on the basis of "fertility" at that time. Olsen and Marsden's work proves that this is an effective and practical method of eliminating all non-fertile eggs, including the parthenogenic type.☆

This soil is hungry for Zinc

LAND is blooming as never before in newly irrigated districts of the Pacific Northwest because scientists have diagnosed and found a remedy for a baffling plant hunger.

This hunger, due to zinc deficiency in Columbia Basin soils, causes spectacular paling and stunting. In severe cases it literally keeps the crops from blooming and bearing. Yields of beans, corn, and a dozen other crops are seriously reduced.

But last summer hundreds of farmers had the satisfaction of watching the remedy at work—seeing it pay a many-fold return.

Soil scientists F. G. Viets, Jr., L. C. Boawn, and associates of ARS and the Washington experiment station learned what causes the trouble and how to correct it. Zinc sulfate sprayed on the foliage or mixed with the topsoil is the remedy—at least the best found so far.

The sickly, pale appearance (chlorosis), stunting, and low yields of the first crops grown in this area some 6 years ago caused the settlers grave concern for the future. Research was started immediately.

In the beginning, alkaline soils seemed to be associated with chlorosis. It didn't occur on all alkaline soils, however, and was found on some non-alkaline soils. Localized extreme chlorosis—especially patches in fields that had lost topsoil through erosion and land-leveling and along the backfill on pipelines—strongly suggested that a soil condition was associated with the problem.

Diagnosis and correction of this problem weren't simple, even though zinc deficiency had been considered a possible cause. Zinc starvation was already known as the cause of rosette or "little leaf" of fruit trees in Central Washington and the "white bud" condition of corn and other crops in Florida. Yet the newfound symptoms didn't resemble these—seemed more like nitrogen hunger.

Early zinc sprays and soil treatments with either zinc or nitrogen were not promising. Later, the scientists found that it takes larger doses. And zinc-treating of the soil calls for nitrogen, too—apparently to help the plant pick up the zinc.

In growing beans, 4 pounds per acre of zinc sulfate sprayed on the leaves or 25 pounds mixed in the soil—a mere 1 to 6 percent as much zinc as the topsoil already has—often makes the difference between a serious crop failure and abundance.

The plant uses less than 1 percent of the new zinc in a single season. But this is enough to double zinc content of the foliage, invigorate the plant, and boost bean yields by 500 to 1,000 pounds per acre. Since 500 pounds of beans pay a 10-fold return for the zinc application, it's easy to see why Columbia Basin farmers are glad they used 200 tons of the chemical on beans last year.

Now that the problem is better understood, Viets and Boawn can detect minor symptoms of zinc deficiency generally throughout the Columbia Basin, even on old irrigation projects where it hadn't been suspected. They think zinc-sensitive crops probably would pay at least the cost of treatment almost anywhere in the basin. Because of their small number of plot replications, however, the scientists are cautious in advising zinc use except where large benefits seem assured—for example, a 300-pound gain per acre of beans.

We need to know still more about which crops are sensitive to zinc deficiency and how to treat them. So the research work is continuing.☆

STUNTED CORN plants' striped, curled blades show extensive zinc hunger in Columbia Basin soils. In extreme cases, corn fails to produce ears. Proper zinc treatment corrects this.

BEAN LOSS is often high from zinc hunger (left). Zinc chloride—as foliage spray (right), or mixed in soil along with nitrogen—raised acre yields of beans 500 to 1,000 pounds.

THIN STAND in an alfalfa field shows zinc hunger where soil was removed in land leveling. Plot in center was zinc-treated. Many of the Basin soils appear deficient in zinc.

Bottom defoliation LOOKS GOOD

COTTON growers have more help this year from herbicidal sprays that speed leaf-drop and boll-opening.

In irrigated sections of the Southwest these harvest-aid chemicals are likely to be used on a substantial scale for the first time to get an earlier, better-quality first picking of cotton.

Scientists of ARS and the Arizona experiment station at Sacaton advanced the first picking in heavy, damp growths of cotton as much as 2 weeks, increased the first picking 2- or 3-fold, and reduced boll rot up to one-half by well-timed defoliation of the bottom part of the plant. The first harvest is the best, highest-priced lint. The earlier that cotton is sold, the higher the price.

HIGH-CLEARANCE rig, with low nozzle stance, sprays chemical on lower plant when bolls are mature and don't need the low leaves.

LEAF DROP admits light and warmth to speed boll opening, curb pests, and give a bigger, better, and earlier first picking of cotton.

Cotton finishes with leaves—sheds many of them—as adjacent bolls mature. Since ripening starts at the bottom and progresses upward, scientist L. C. Brown believed the plant could spare lower leaves by the time of the first picking.

Three years' experiments and one year's limited but successful farm test verified this theory. Using ARS-developed high-clearance spray rigs, Brown sprayed the lower half of the plant 35 or more days after flowering. Bolls were 50 to 60 percent open and others too firm to dent with the thumb and too tough to be cut easily with a sharp knife. Earlier defoliation spraying causes damage.

Standard cyanamids and chlorates and the experimental amino triazole gave good defoliation and corrected objectionable conditions.

These herbicides killed or stunted grass and weeds that interfere with picking and reduce the grade. Early spraying sometimes destroyed weeds so effectively that the usual last cultivation was unnecessary.

ARS, the State experiment stations, and the chemical industry have experimented for 10 years with total plant defoliation—spraying or dusting from above, and frequently by airplane, when the plant has finished maturing bolls. This had its widest application in the Southeast.

Total defoliation helps with the final picking but not the first one. Applied too early, as it often is, this reduces boll development, lint yield, and lint grade. On rank growths, a follow-up, at additional cost, may be necessary to reach the lower leaves. But after bottom-defoliation, one spraying—if any at all is needed—will be enough at the last picking.

Last year at least 3 million acres were defoliated—mostly by late-season total-plant treatment to dispose of trash. Airplane-dusting with calcium cyanamid just before final picking is still the most general defoliation practice in the Southeast after 10 years in use.

Many growers in the Southeast learned through use last year that the new experimentally developed herbicidal sprays—sodium and magnesium chlorates and the newly de-alkalized soluble sodium cyanamid—give a quicker leaf-drop and generally less interference with maturing and opening of bolls. These chemicals will be plentiful again this year.

Results with two other new chemicals, sodium ethyl xanthate and endothal, have been good but less consistent. Another practice from research—spraying with pentachlorophenol in oil—kills leaves and opens bolls promptly. It has many advocates even though dried leaves hang on and create trash in the picking.

Spraying may gain in popularity, now that practical high-clearance spray rigs are appearing on the market. Small growers, who can't afford the rigs, must continue custom dusting and spraying or forego defoliation completely.

The Cotton Belt is still looking for better defoliants that will kill leaves promptly, permit fibers to mature properly, and prevent second growth by the plant. Two experimental chemicals, NP–1098 and Phillips No. 713, are promising for the humid Southeast and the Texas-Oklahoma areas, respectively.☆

more Cotton with Bees

FLOWERS on Pima S–1 cotton plant are counted and dated by entomologist S. E. McGregor in Arizona experiments. These tests indicate that the blossoms cross-pollinated by bees set more and larger bolls than blossoms that aren't visited.

ANTHERS discharge pollen as blossom begins to open around 8 a. m. Bees can cross-pollinate cotton flowers up till about noon.

OUR self-fertile cotton plant can reproduce its kind without help from winds, insects, or animals to carry the fertilizing pollen from the flowers of one plant to those of another.

Even so, cooperative experiments by ARS and Arizona experiment station entomologists show that it may be profitable to give nature some assistance. At the U. S. Southwestern Bee Culture Laboratory, Tucson, yields were increased 22 percent through accidental cross-pollination of cotton by honeybees seeking nectar and pollen from the flowers.

Bees had their greatest effect on early-flowering cotton, causing 20 percent more of the blossoms to develop bolls. These early-set bolls contained an average of 23 seeds—4 more than bolls from plants denied bees. Average lint yield was boosted 21 percent by the insects.

Research plots were grown in plastic-screen cages. The scientists are planning further experiments to see whether the pollinating honeybees are as effective in raising yields under ordinary field conditions.☆

BEEHIVES alongside blossoming Arizona cotton are inspected by commercial beekeepers who are cooperating with the entomologists in studying the importance of honeybees as pollinators of cotton.

CAGES of plastic screen, 12 by 24 feet and 8 feet tall, help the scientists get accurate results in the Arizona tests. Bees are maintained in some cages (see foreground) and excluded from others.

DELICATE OPERATION by scientist saves tiny embryos that result from crossing the two species. With sterile instruments and hygienic conditions, the scientist operates under the transparent hood, cuts the embryo away from its ovule, and places it in the bottle of sterile enriched nutrient agar.

EMBRYOS of a normal species plant on ag showing several stages of early developm outside the parent ovule. From top, t were photographed at the ages of 7, 8, 10, 11, 12, and 14 days after pollinati

SWEETCLOVERS, nutritious and productive, are important as forage and soil-building crops. *Melilotus alba* strain of white, left, has little of the bitter coumarin. Yellow *M. officinalis* is a high-coumarin species—but drought-tolerant. Farmers need low coumarin and drought tolerance in one plant.

Inc

PLANT scientists are elated at rearing two "incubat babies" and two generations of their descendants th carry farmers' hopes for a new race of truly *sweet* swe clover—one with little of the chemical coumarin.

The agriculturally-important white and yellow bienni sweetclover species are high in coumarin, which great limits their feeding value. Coumarin is bitter. In spoil hay or silage, its decomposition product causes nonclotti of the blood and hemorrhaging. Fortunately, there's man-made low-coumarin strain of the white species.

Plant breeder G. T. Webster created the "incubat babies" by crossing this low-coumarin white and t common yellow sweetclover—the two important spec for soil improvement and forage. This was done in jo ARS-Nebraska experiment station research at Lincoln.

The hybrids are unique. They are the first crosses tween the white and yellow species known to reach mat ity. Their survival was due to a delicate operati cutting the 12-day-old embryos away from the mot ovule. They were moved to a special nutrient medi in a favorable environment, much as a premature hun baby is sheltered in an incubator. And they contain important low-coumarin genes from the white parent.

VIALS, with their precious but inconspicuous embryos on or just under agar surface, were kept in diffused light and at controlled temperature—like eggs in an incubator tray—until leaves and roots were well established.

NEW HYBRID is one of the two reared to maturity. Individual flowers were pollinated—some selfed and others back-crossed to the parents—and bore seeds. Many plants and a subsequent generation have been produced.

EIGHT HUNDRED plants descended from the two hybrids are growing in a greenhouse at Lincoln, Nebr. They are being studied for coumarin content, feed quality, yield, and adaptability to diverse growing conditions.

...bator sweetclover hybrids

These hybrids now have given rise to several hundred first- and second-generation descendants, some by self-pollination and some by backcrossing to both parents. They resemble the yellow-flowered ancestor in many ways. Webster hopes to preserve the low-coumarin characteristic already evident in some of these plants, along with the superior drought-tolerance of the yellow species, as the foundation of a non-bitter race of yellow sweetclover.

Existence of the several hundred prized plants, now growing in a Lincoln, Nebr., greenhouse, was possible because of *two*—not just *one*—basic research achievements. In both cases special techniques saved inter-species hybrids. In both cases the hybrids were an essential link in carrying important genes from the coumarin-free wild *Melilotus dentata* to its incompatible species cousin, the yellow *M. officinalis*, which is high in coumarin.

The wild European species, *M. dentata*, has no agricultural value. The common yellow species is an important forage and soil-building legume. It is productive, nutritious, and the sweetclover most likely to reseed under low-rainfall conditions of the Great Plains.

In carrying the low-coumarin genes from the wild to the common yellow species, the white sweetclover *M. alba* was the center stepping stone. *M. alba* was strictly a high-coumarin species until scientist W. K. Smith, of the Wisconsin experiment station and ARS, crossed it with *M. dentata* a number of years ago.

Several crosses had been made between these two species but the resulting hybrids always lacked chlorophyll. Unable to produce their required carbohydrates, they died. By a delicate operation, Smith grafted his albino hybrids onto healthy sweetclover plants that restored green color. The hybrids thus grew to maturity, bore seeds, and by a series of backcrossings to the white parent, established a strain that was essentially an *M. alba* with only 10 to 15 percent as much coumarin as the original species has.

Ever since Smith fixed the low-coumarin genes in the white-flowered species, scientists have wanted to pass these genes on to the yellow sweetclover. All their hybrids died in the mother plant—all, that is, until Webster found a way to make them live. In his recent work, he closed the final link in the passage of low-coumarin characteristics from *M. dentata* to *M. alba*, to *M. officinalis*. And the young aristocrats growing at Lincoln are present guardians of the genes. Of course, they still are experimental plants—not more than this.☆

Cool cash in a SHADE

HOT weather bothers most animals. On the farm, it means less milk in the pail, fewer eggs in the nests, less meat on the livestock.

That's why agricultural engineers in ARS and cooperating State experiment stations, working together the last 8 years, have studied different methods of reducing the heat load on animals in warm climates.

An animal is constantly producing heat. Even the switch of a tail, the beat of a heart, produces heat. So do other body functions, including growth and the making of milk and eggs. An animal turns into heat nearly a third of all the food it eats.

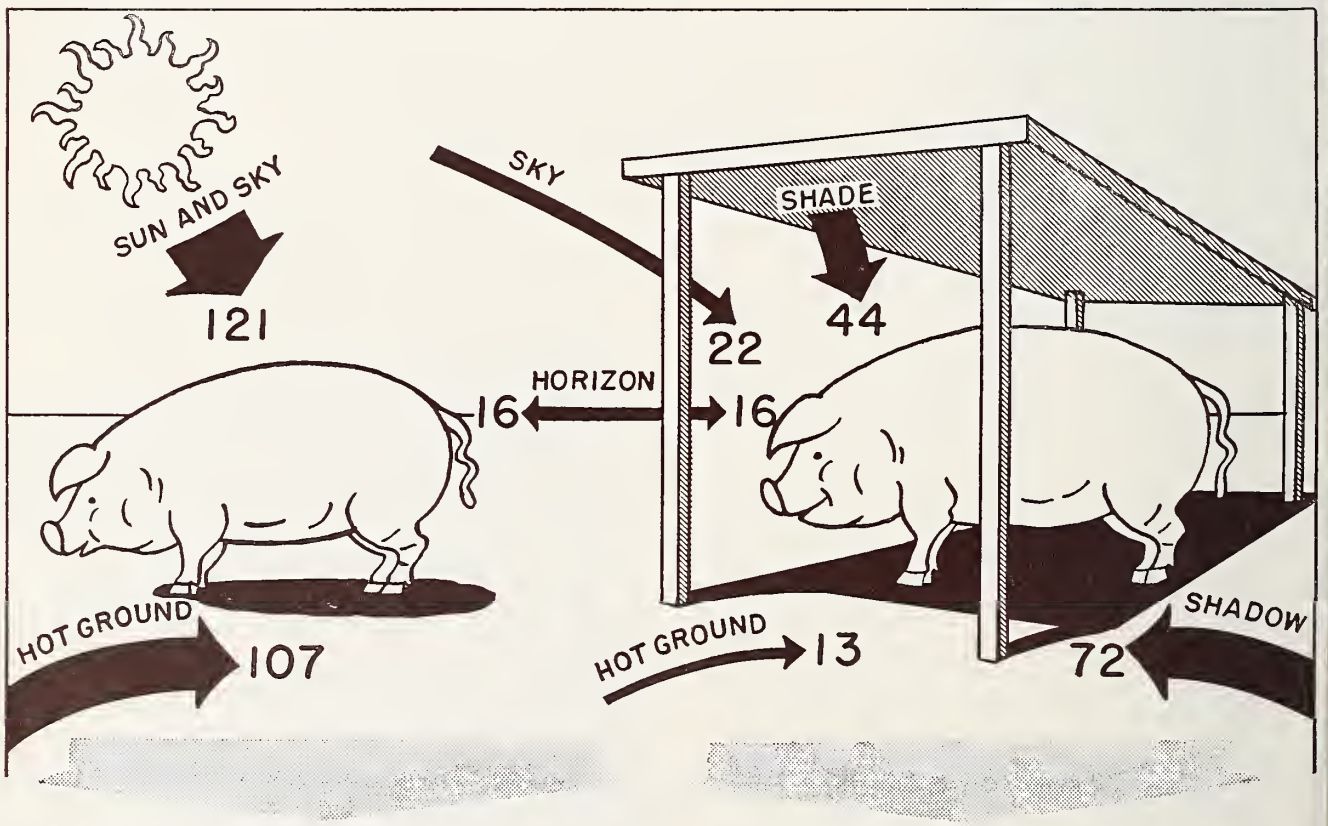
Many animals—hogs, chickens, and European breeds of cattle—sweat little or none at all. So heat complicates their living. Their pulse rate slows and their blood shifts to the inside as natural air temperature increases. They pant, giving off body heat in water vapor. Air movement over the body surface releases some heat. More is lost in heat waves radiated by the body.

But the animal has more and more difficulty getting rid of body-generated heat with each increase in the natural air temperature. When the surrounding atmosphere goes above normal body temperature, the animal absorbs heat from the surroundings. This heat must also be given off. mostly in water vapor from the lungs.

A heat-distressed animal eats less—and naturally produces less.

Several ways of helping an animal maintain its heat balance have been tested and found helpful. These include cool drinking water (65° F.). sprays, air-cooled shelters, and several different types of shades.

At the California experiment station, agricultural engineers T. E. Bond and C. F. Kelly and livestock special-



IN SUN: 244 B. t. u. per hr. per sq. ft. **IN SHADE: 167 B. t. u. per hr. per sq. ft.**

RADIATION on an animal in the sun and one protected by a shade on a typical summer day at El Centro, Calif. (B. t. u.: British thermal unit).

ist N. R. Ittner found artificial shades the most economical means of controlling radiation.

A shade, of course, does little to alter the air temperature, humidity, or the wind velocity under it—unless it happens to be closed on one or more sides. Main value of a shade is to shield the animal from the intense radiation of sun and sky.

The animal under a flat shade is still exposed to some radiation from the sky, as well as from the horizon, hot surrounding ground, and from shade material itself. It's with this last—radiation from the shade material—that the engineers have recently concerned themselves. This is the only part of the radiant heat load that's changed by altering the material's surface characteristics.

The engineers discovered that radiation from a flat metal shade is cut significantly by painting its top a reflective white and its underside black. This dark surface absorbs most of the radiation from the hot ground, thereby reducing the energy reflected back down on the animal.

In testing two portable shades painted this way, the engineers further found that the heat load was appreciably less when the shade was placed over green grass rather than dirt. The grass cover—though it reflects heat more readily than the dirt surface—is much lower in temperature and thus has less heat to give off.

A shade roofed with 4 to 6 inches of hay held between two layers of woven-wire fencing has proved cooler than most other types. For one thing, the uneven character of the hay apparently acts as a black surface. Then, too, the hay probably loses much of its heat in the passage of air over and through it. And the insulating value of the hay keeps the bottom surface from getting much heat by conduction from the top.

Further work is underway on effective, practical types of shades.☆

REPLACEMENTS:

raise or buy?

Whether it pays a dairy farmer to raise his herd replacements or buy them is a question that may be answered by a cooperative study now being made in the Northeast by ARS and the Connecticut and New Hampshire experiment stations.

Underway about 18 months, the study seeks to make available to farmers, by analysis of their joint experiences, the average conditions under which one practice or the other should be most profitable. This research, of course, isn't expected to reveal any hard-and-fast formula that can be applied to all dairy farms.

Information—including data on such matters as feeding, production, and mortality rates—is coming from dairy farmers, Dairy Herd Improvement Association records, experiments, and other sources. Points being considered in the study also include the disease factor—that is, the risk involved in buying rather than raising replacement stock.

Findings so far show that the farm's location in relation to a market outlet for milk frequently determines whether a farmer should raise or buy his dairy-herd replacements. Close-to-market farms are usually operated more profitably if the dairyman concentrates on milk production. In such areas, dairymen attempt through heavy feeding and other means to get the most out of cows during their most productive years—which seldom run more than 4 or 5.

Other important considerations include the prices that dairymen receive for milk, the value of land close to a market, and labor costs.

Farmers distant from market are more likely to raise not only their own replacements—for extra income—but also additional animals as replacements for other dairymen.

Illustrating the difference in the practices as between southern and northern New England is the fact that culling rates average 25 and 18 percent respectively. Average yearly milk production in southern New England is about 900 pounds greater.

Despite the differences, many replacements are raised in both areas and no blanket rule can be laid down as to whether either practice is economically sound or unsound.☆

Labor **down**—*Quality* **UP**

Less handling and faster movement of apples from orchard to cold storage means better quality fruit available at lower cost to consumers.

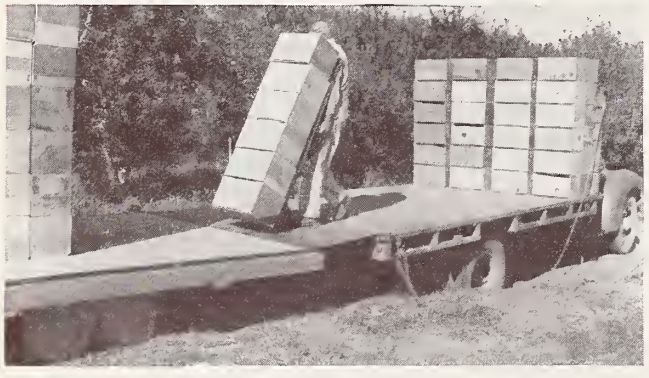
Improving these procedures was the object of a 2-year study of handling methods in Pacific Northwest apple orchards. The research was carried out by engineers of the Washington State Apple Commission under a contract with USDA.

Pictured here are some of the ways these engineers found of improving quality and, at the same time, saving labor—(1) by reducing handling that causes bruising; and (2) by moving the fruit to cold storage more rapidly, thus preventing field deterioration that's often caused by rain, frost, or normal weather exposure.☆

Complete information concerning this study is given in USDA Marketing Research Report No. 55, "Methods and Costs of Loading Apples in the Orchard in the Pacific Northwest." It's available for 20 cents, Superintendent of Documents, Government Printing Office, Washington 25, D. C.

FASTENING HARDWOOD STRIPS to orchard trailer bed helps ground crew stack fruit boxes on edge of trailer and push them into place. Compared with the standard method—one man lifting from the ground, another stacking on the trailer—this procedure reduced the cost of labor from $3.50 down to $2.90 per 1,000 boxes of apples.

BUILDING PALLET LOADS directly on a low-slung trailer at the orchard increases the loading cost slightly, but permits use of fork-lift trucks at the plant at a great saving in equipment cost and labor. The trailer's stack limit—5 boxes high rather than 6—takes more pallets and would waste a large amount of space in most storage plants.



GRADING THE GROUND enables road truck and orchard trailer to meet on same level for convenient shift of apples by two-wheel hand truck. Transfer in this way cost $3.02 per 1,000 boxes compared with $4.20 when boxes were carried manually from the trailer and stacked on the truck. This simple procedure saved 28 percent.

ASSEMBLING AND LOADING truckloads was done with a clamp-type hand truck at an orchard platform for as little as $4.57 per 1,000 boxes if separate approaches for trailers and highway trucks were at proper elevations to level each vehicle bed with the dock. Stacking boxes on the ground and reloading them manually cost $7.20.

Fruit CANNING WASTE is a source of food and feed

About mid-July, Santa Clara County (Calif.) pear canneries will swing into their busy season. At the same time, a commercial plant near San Jose will also go into action. daily converting over 500 tons of waste from the canneries into molasses and dried pulp for stock feed.

This process was developed during three years of research by the ARS Western Regional Research Laboratory at Albany, Calif., in cooperation with Canners' League of California and Cling Peach Advisory Board.

Cattle and sheep like the sugar-rich feeds and thrive on them. Last year the plant processed about 20,000 tons, or 40 percent of the area's total pear waste. The output found a ready market at $23 per ton for the molasses and $21 for the pulp.

If all this pear waste could be so processed, the development would probably be worth $300,000 annually at today's relatively low feed prices. And it would avoid dumping quantities of waste in a district that produces a third of our canned pears.

A process for converting the edible portion of pear waste into syrup for canned pears has been developed by ARS Fruit and Vegetable Products Laboratory, Prosser, Wash., in cooperation with Apple Growers Association, Hood River, Oreg.

Profit from this process. not counting equipment cost, is estimated at $7.70 per ton of waste. But the method isn't yet into commercial use.

Large quantities of pears, peaches, and other fruits are processed in Washington and Oregon. Canners there are considering using the two methods—for gross and for edible waste—separately or combined.

In the stock-feed process, researchers developed these key steps for converting the slimy waste to a clear juice and an easily dried press cake: addition of lime, followed by treatment in a conditioning trough; a new-type dejuicing press that handles treated material faster and cheaper than did available equipment.

This process works equally well when the waste contains such pulpy fruits as peach, grape, and tomato.☆

Two ways to get at a bad PEACH PEST—plum curculio

ARS entomologists are making headway on two different but promising methods of controlling a serious peach pest, the plum curculio:

1. Dieldrin, used as an early-season foliage spray in field-scale trials, gave better early control of this pest than such recommended insecticides as parathion and EPN.

2. Aldrin or dieldrin, mixed with the soil in laboratory tests, destroyed nearly all the plum curculios that entered the ground to pupate.

A drawback of dieldrin as a foliage spray is its relatively long-lasting toxicity. Use in a regular spray schedule might leave residues on peaches. But restricting it to the early season and following with parathion—which poses less of a residue problem—gave entomologists some of the advantage of dieldrin's excellence in plum curculio control.

Two tests with dieldrin-parathion at Fort Valley (Ga.) Fruit Insect Investigations Laboratory gave these results: infestation of peaches that dropped early in the season was cut to 4.1 percent in one test and 0.9 percent in the other. Harvest-time infestations were 0 to 0.2 percent. A parathion spray schedule resulted in 4.3 percent infestation of early-dropped fruit and 1.1 percent infestation of peaches at harvest. Infestation of EPN-treated fruit amounted to 4.6 and 0.1 percent.

As soil treatments, both aldrin and dieldrin gave good control of plum curculios. Applications were effective more than a year. At four pounds an acre, aldrin completely prevented emergence of plum curculio adults. Dieldrin used at the same rate allowed only 0.7 percent emergence. Nearly 50 percent of the plum curculios that entered untreated soil as larvae later emerged as adults.☆

Ethylene gas that TOMATOES produce helps ripen them

Tomatoes give off a gas—ethylene—that accelerates their ripening, plant physiologists P. H. Heinze and C. C. Craft, of Agricultural Marketing Service, learned recently.

Some scientists have questioned the advantage of treating mature green tomatoes with ethylene in storage ripening. Heinze and Craft found that moderate ventilation permits the naturally produced ethylene to escape before it can have much effect. Then an artificial supply of ethylene will accelerate ripening. The need for added ethylene depends on how much of the ethylene produced by the tomatoes is allowed to accumulate in the ripening rooms.

These findings point to the possibility of hastening the ripening by limiting the ventilation. Tomatoes release carbon dioxide gas and it also accumulates in the air. It will require further study to show how far this ventilation control can be carried without injuring the tomatoes from too much carbon dioxide.☆

New time-freedom for cooks

Food-freezing experiments with large-scale recipes offer new time-freedom for homemakers who cook family meals, for chefs in restaurants and catering establishments.

Combination main dishes such as meat pies, stews, and casseroles are thrifty and popular—but they often cause the cook an anxious race with the clock when they have to be prepared from the start to meet a meal deadline. Now these dishes can be made up in quantity and held in the freezer for hurry-up occasions.

Little research has been reported on freezing such food, either for home or restaurant. And making up a large quantity—to serve some fresh, if desired, but in any case to have enough to freeze a number of servings—is a new experience for many homemakers. So research-based directions for quantity preparation and freezing may help avoid mistakes that would waste a great deal of food.

Developing quantity-scale recipes has been one of the research jobs of recent years in ARS food laboratories at the Agricultural Research Center, Beltsville, Md. The goal is to add to acceptable ways in which abundant foods can be served by restaurants and other large users as well.

For the freezing experiments, the quantity-service laboratory provided combination main dishes in 24 or more portions. A few cooked vegetable dishes, baked products, and fruit desserts that take considerable preparation were also included. The food was rated for eating quality before and after a number of different periods of time in frozen storage.

Food technologists of the Human Nutrition Research Branch found many of the prepared foods excellent in flavor and texture after freezing. But problems were often encountered. A meat loaf might be too crusty, a sauce too thick, a baked dish off in flavor. Such foods were sometimes improved by shifting just one procedure—perhaps shortening cooking time or changing an ingredient. These findings are reflected in directions for various dishes.

Here are some of the general recommendations from this work:

Frozen cooked food mixtures can go straight from a zero-cold freezer to a 400° F. oven to be reheated for serving. Flavor is as good and reheating very nearly as quick as when the food is thawed beforehand.

Jellied salads and other prepared foods to be served cold are best thawed in a refrigerator. Ice crystals that form in freezing—these are water separated out from solid food—blend again into a smoother mixture when such foods thaw in a refrigerator rather than at room heat.

Prepared mixtures should be stored no more than 2 to 3 months. They will keep somewhat longer, but this time limit is in the interest of best eating quality as well as economical management of freezer space.☆

Taste-testers like new APPLE-JUICE superconcentrate

A delicious new apple-juice superconcentrate developed by the ARS Eastern Regional Research Laboratory has passed consumer taste tests.

Volunteer tasters in two New York department stores tried the full-flavor juice reconstituted from this superconcentrate and compared it with single-strength bottled juice made in the usual way from the same lot of apples. In this trial, run with the cooperation of a large food manufacturer, tasters picked the superconcentrated product three to two.

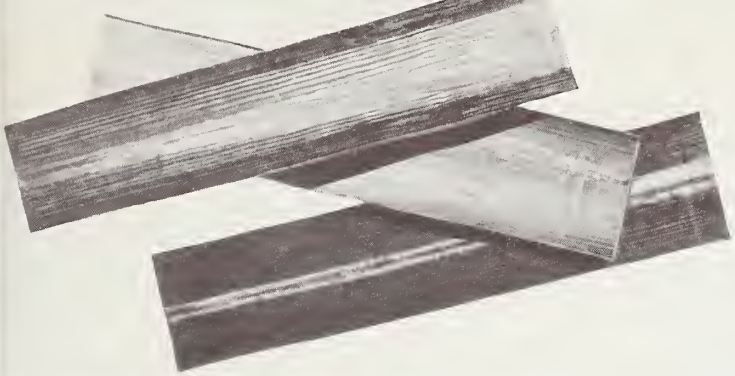
This preference was purely a matter of flavor and doesn't take into consideration such advantages as compactness and need for only ordinary refrigeration. Regular frozen-juice concentrate is diluted with 3 parts of water, so the new 6-to-1 superconcentrate goes twice as far.

A blend of Jonathan, McIntosh, Stayman-Winesap, and Northern Spy apples was used for the tests. Part of the juice was run through equipment developed at the Eastern laboratory to recover fresh-fruit aroma (AGR. RES., Aug. 1953). The rest was frozen for convenience in scheduling work and was subsequently thawed, pasteurized, and bottled as the single-strength juice for the test.

The deflavored juice was next treated to remove pectin, then concentrated by evaporating the water. The aroma—called essence—was now restored to the concentrate to give it the fresh-apple character.

When tested, the samples were prepared out of the taster's sight to avoid any influence from seeing one product made up from a concentrate. But the pitchers holding each juice were in full view. Both juices were served at a temperature of 45° F.

Most of the 375 tasters based their choice on flavor. The concentrate was generally selected because of "more flavor," "better flavor," "more apple flavor," "more natural flavor." A minority liked the standard bottled juice for its greater "body" and somewhat robust, earthy flavor.☆



Making lumber last Longer

COMMON molds have been thought to cause mere superficial discoloring in pine lumber and poles.

Now it has been found that molds may cut down the useful life of these products. In some cases, however, the fungi can be used against themselves to make wood more lasting.

Forest Service scientists working on problems of wood deterioration have learned much about the importance of the wood-moisture relationship in the durability of houses and other structures. Any factor that changes the wood-moisture relationship, says forest pathologist R. M. Lindgren, is important for helping or hindering deterioration of lumber.

Molds and staining fungi penetrate deep into sapwood and make microscopic openings in it. This causes the wood to take in much more rainwater than before. On the other hand, such opened wood can take up 4 to 5 times as much preservative solution in a short soak as uninfected wood. This increases the effect of the treatment.

When mold-infected wood is painted, says Lindgren, moisture from rain builds up quickly because drying is retarded. Swelling and shrinking increase, joints open, and fastenings loosen—all of which results in more entrances for water and more pockets where it can collect.

Only in the past few years have we come to know that these so-called invisible mold infections are the indirect cause of much of the early decay in untreated siding, trim, porch flooring, window frames, boxes, posts, timbers, and other wood items that have to stand out and take it.

The forest pathologists have used their new knowledge of molds and woods to clear up some old puzzles.

Uneven changes in the permeability of wood greatly affect the efficiency of preservative treatments, whether they are applied by pressure or not. Back of this may often be the fact that mold infection varies within wide limits, even in the same pile of lumber, bolts, or poles. Such variations in the effectiveness of treatments were formerly laid to differences in the wood.

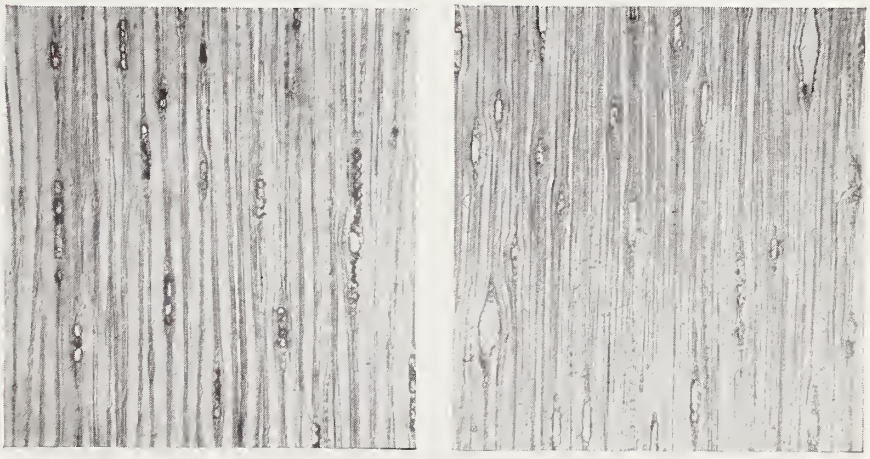
Application of antiseptic sprays to ends and barked spots is one control method for fungus deterioration of logs and bolts. Such treatments usually give protection for at least 2 to 3 months. Film coatings for the ends of such pieces hold back the formation of seasoning checks—an added safeguard against rotting.

PINE POSTS above, after 24 hours in 15 inches of preservative, show effect of mold on permeability. Dark solution penetrates most where the mold infection is heaviest.

By including insecticide in the spray, insect damage can be reduced. But this extra precaution requires that the entire log be treated.

Success of these treatments usually depends on immediate or early application after the wood is cut.

In spite of progress in reducing wood deterioration, losses of this sort are still estimated to be around $300 million a year. Much of this waste could be stopped by relatively simple precautions: drying wood properly and keeping it dry, or using preservative-treatment woods or those that are naturally decay resistant.☆



ENDS OF WOOD RAYS look different in these two longitudinal sections of pine. The reason is mold. At left, rays are filled with the cells that grew there, showing that this piece of wood isn't infected. At right, the rays have been opened up by fungi, making this mold-infected piece of wood much more permeable to water—or to a preservative solution.

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AGRISEARCH Notes

PEST: imported fire ant

Three of the newer insecticides—aldrin, chlordane, and dieldrin—control the imported fire ant, an insect that's increasingly troublesome in southern States.

Research by ARS entomologists shows that any one of these organic chemicals, sprayed on mound nests or (for widespread infestations) spread over the entire infested area, can be relied on for good control.

The imported fire ant slipped by quarantine barriers about 1920, showing up around Mobile, Ala. Since then the insect has spread into 10 States—from Florida to North Carolina and westward to Louisiana and Texas.

This pest feeds on many vegetable crops and attacks unprotected animals such as newborn calves and pigs. A biting, stinging attack on man by a heavy infestation of imported fire ants can bring field work to a standstill.

Details are given in new USDA Leaflet 350, "The Imported Fire Ant—How to Control It." Single free copies can be obtained from Office of Information, U. S. Department of Agriculture, Washington 25, D. C.☆

TEAM: crimson and Bermuda

Crimson clover and Coastal Bermuda grass go together like ham and eggs, says G. W. Burton, ARS geneticist at Georgia Coastal Plain Experiment Station, Tifton.

Burton cites Tifton tests in which this mixture—without any added nitrogen—produced an average of 363 pounds of beef per acre annually during the last 2 years after the clover had matured. That's as much beef as 75 to 80 pounds of nitrogen out of the bag would produce.

Adequate phosphorus and potassium, essential for good clover growth, were supplied to all test pastures.☆

RICH: juice of fresh prune

A prune juice of rich scarlet color and full flavor has been developed from fresh prunes by ARS research at the Western Regional Research Laboratory, in cooperation with the Washington State Fruit Commission. This teamwork opens a new market for the Italian prune, principal variety grown in the Pacific Northwest.

The fresh prunes (commercial juices are usually made from dried prunes) have been processed into a single-strength juice and a four-fold concentrate. The fruit must reach full maturity for the most satisfactory product.

Laboratory methods should be readily adaptable for commercial use because the required equipment is commercially available. For the single-strength juice a screw-type blancher and bag-type press are used. Concentration can be carried out in equipment and under conditions of time and temperature that are also suitable for production of beverage-type grape or apple concentrate.☆

LOOK: into a plastic bag

Laminated plastic bags make a desirable package for marketing perishable commodities like shelled nuts.

A study by Agricultural Marketing Service scientists indicates that these transparent bags—consisting of two or more layers of film cemented together—are (1) impervious to moisture and oxygen and (2) sturdy enough to undergo handling without undue breakage.

Perishables such as shelled nuts often deteriorate rapidly unless they are put up in vacuum-packed tins. But tins aren't entirely satisfactory because consumers like to see the nuts before they buy.

In recent tests, the shelf life of shelled nuts packaged in laminated bags was prolonged for as much as 3 months without refrigeration. Pecans and walnuts, packed in such bags under vacuum or gas, showed good quality after 3 months' storage at 70° F.☆

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